Continous transcutaneous carbondioxide measurement from the fetal scalp during labour

Löfgren,O. Dept.Ob/Gyn,General Hospital,Malmö S-214 01, Sweden

The technique for continous transcutaneous oxygen monitoring may, under certain circumstances (1,2) be used as an additional tool in fetal surveillance during labour. It was early realized that it would be possible to measure changes in the fetal carbondioxide partial pressure using the same basic technique, and the first serial study appeared in 1980 (3).

In the current study, a modified Stow-Severinghaus electrode (Radiometer A/S,Copenhagen,Denmark) was used in a consecutive material of 15 deliveries. All fetuses were presented by the vertex.Before application the electrode was calibrated in 5% CO_2.
It was possible to applicate the electrode in all patients within 6 min., using a technique described by Löfgren(2). The mean cervical dilatation was 7 cm (range 4-10). At delivery, blood samples were taken from the umbilical cord for blood gas analyzis. CTG was monitored in all patients.

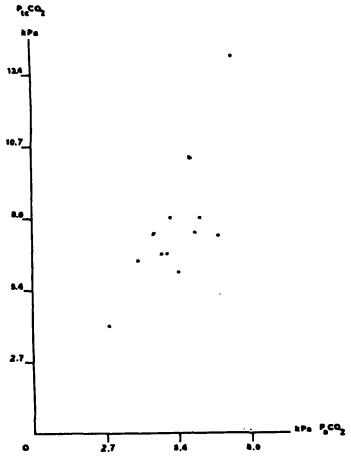

Fig.1

There was a statistically highly significant correlation between transcutaneous carbondioxide partial pressure ($P_{tc}CO_2$) and PCO_2 in the umbilical vein (P_aCO_2) in all patients with a normal CTG ($r=^{a}0.9$;n=12, Fig.1)

In 10 patients the electrode fell off or was deliberately removed just before delivery, while in 5 pat. the electrode was left on the scalp until at least 20 min. post partum.It was thus possible to study PCO_2 when these fetuses changed from placental to air breathing. (Fig 2).

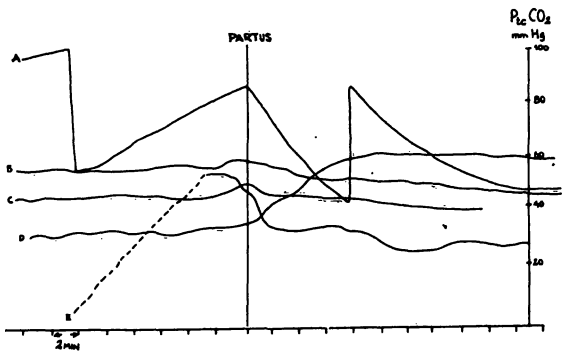

Fig.2

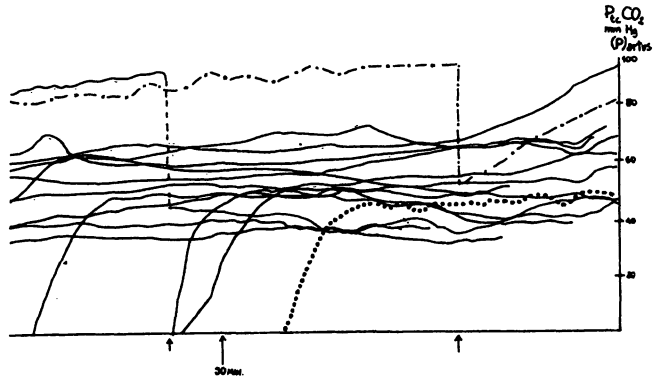

Fig.3

Fig. 3 is a composite figure of all $P_{tc}CO_2$-recordings in the material. The mean fetal $P_{tc}CO_2$-level is about 50 mm Hg.

0300-5577/82/0102-0039 $ 2.00

In one fetus with an initially very high $P_{tc}CO_2$-level (Fig. 3 and 4), and a normal CTG, 12 min. before delivery, and after a further increase of $P_{tc}CO_2$ a sudden fetal bradycardia appeared. A vaccum-extraction was prepared but not performed, as the child was spontaneously delivered. The electrode was left in situ. After stimulation and suction the child started to breath spontaneously, and the $P_{tc}CO_2$-level started to decrease. The level stabilized at 45 mm Hg after 20 min. (Fig.2). pH v/a=7,23/7,03; PCO_2 v/a= 45/89 mm Hg.

Another child with almost the same CTG-pattern (bradycardia ad 70 bpm during 6 min.), but with a normal $P_{tc}CO_2$, had normal blood gases and no acidosis.

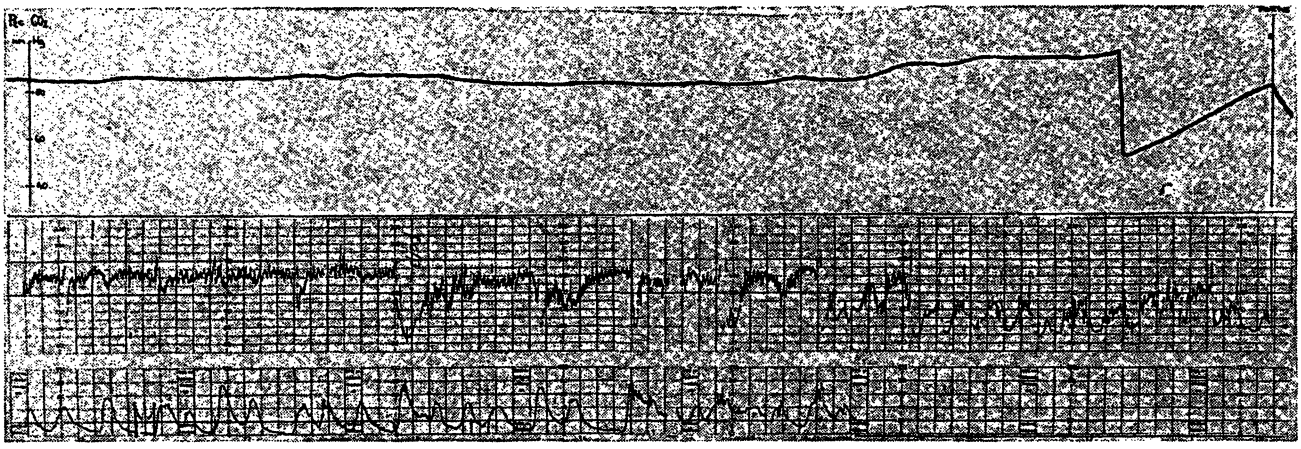

Fig.4

Conclusions

There is a statistically highly significant correlation between fetal $P_{tc}CO_2$ and arterial PCO_2.

Fetal $P_{tc}CO_2$ 1,3 x P_aCO_2. (umbilical vein blood)

A normal CTG does not guarantee fetal normocapnia.

Bradycardia and late decelerations may appear also during fetal normocapnia.

An increased fetal $P_{tc}CO_2$-level simultaneous with bradycardia/late decelerations, support the diagnosis 'asfyxia foetus imminens'.

This potential parameter for continous fetal surveillance during labour, has made it possible - for the first time- to study PCO_2 when the fetus changes from placental to lung breathing.

References:

1.Huch A,Huch R, Schwender H,Rooth G,:Cont.transc.... .. Br.J.Obst.Gyn. 84 (1): 1-39, 1977.
2.Löfgren O: Continous.....Am J Ob/Gyn 141, 729, 1981
3.Löfgren O: Cont. $P_{tc}CO_2$..,Crit Care Med 9,750,1981

Dr.O.Löfgren, Univ.of Lund, Dept.Obstet.&Gynec., S-21401 Malmö